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ADVANCED COMPUTATIONAL MODELLING OF FREE SURFACE FLOWS AND APPLICATIONS

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ABSTRACT

The simulation of free surface flows, characterized by the interaction between air and liquid phases, are integral to numerous natural processes, ranging from coastal hydrodynamics and environmental flows to engineering applications such as dam break analysis, flooding, and wave-structure interactions. Modelling these flows accurately presents a significant challenge due to the complex physical phenomena involved, such as turbulence, wave breaking, and dispersive effects. In recent years, computational fluid dynamics (CFD) methods have made substantial progress in capturing these phenomena and dealing with the nonlinear aspects of such modelling. However, selecting the appropriate modelling strategy to meet practical aspects remains a key question depending on the accuracy and computational cost for a range of applications. This mini-symposium aims to bring together researchers and practitioners to discuss advanced computational approaches to simulating free surface flows, focusing on strategies ranging from non-dispersive to dispersive methods, alongside different types of modelling equations that may involve numerical tecchniques as well as emerging data-driven and physics-informed machine learning methodologies [1] hence allowing for producing models from data and/or combining data and mathematical-physical modelling approaches in hybrid modelling strategies.

REFERENCES

[1] Karniadakis, G.E., Kevrekidis, I.G., Lu, L. *et al.* Physics-informed machine learning. *Nat Rev Phys* **3**, 422–440 (2021).